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extensive three-dimensional world. The former problem was in principle solved by Wheatstone, and its perfection in securing an orthostereoscopic effect—apart from convenience and refinement—follows upon the analyses and elimination of the incidental and unintentional deviations between the optical system of the photographic reproduction, and that of the original visual experience. Invention has been fertile, especially in devices for presenting to the eyes the two divergent views, leading to such diverse pieces of viewing apparatus as the reflecting stereoscope of Wheatstone, the refracting one of Brewster, the lenticular of Helmholtz, the complementary chromatic effect of Rollman-d'Almeida, the Ives parallax stereogram, the unilateral reflecting stereoscope of Pigeon, and in another direction, to the invention of the Verant lenses; in yet another, to the devices for stereoscopic projection, and again to the study of pseudostereoscopy. The enlargement and precision of stereoscopic vision has led to the stereotelemeter, in which the projection of a scale incorporated in the optical system of the instrument (by engraved lines on the objective, or equivalent device) over the distant landscape gives accurate stereoscopic judgments at a telescopic range. Conversely the stereo-comparator provides the means of restoring to space-relations of the third dimension, the minute transverse deviations of the two divergent representations resulting from any given real (or calculated) base line. From this, in turn, other problems diverge, such as that of constructing an equally precise photographic stereo-camera, and again of restoring from the stereograms thus resulting, the actual object—say, a statue—in its three dimensional reality. No less accurately than a phonographic disc preserves a voice for posterity may a solid reproduction of our actual bodily self in length, breadth, thickness of build and feature, be embodied on the twin record of a true stereoscopic print. Finally, of applications of stereoscopic principles there are many and varied examples, from the detection of forgeries to that of the variability of

stars, or examination of microscopic specimens.

Pullfrich's article is devoted not to the description or analytic aspects of the problems of which these several inventions form the solutions, but to the clear and concise statement of the physical (and mathematical) aspects of the constructions involved, with due reference to the functional service sought. For this specific purpose, as well as for a general survey of the recent advances in stereoscopy, the pamphlet may be unreservedly recommended.

JOSEPH JASTROW

*De Fabricatie van Suiker uit Suikerriet op Java.* By H. C. PRINSEN GEERLIGS. Amsterdam, J. H. De Bussy. 1911. Second edition. Pp. xxiv + 500 + xx.

Desire to keep pace with the rapid advances which the art of sugar-making is constantly experiencing has induced Prinsen Geerligs, the well-known Dutch sugar-expert and author, to prepare this new edition of his book, which was originally published in 1907.

The work is divided into three sections. The first of these is given over to a consideration of the raw material and discusses the occurrence and distribution of the various constituents of the sugar-cane—sucrose, dextrose, lævulose, invert-sugar, fiber, the pectins, organic acids, cane-wax, coloring matters, nitrogenous bodies and mineral matters.

The second section is concerned with the technology of sugar-making. Attention is first given to the extraction of the juice from the cane and in this connection there are considered, sugar-mills, processes of diffusion, the treatment of bagasse and determination of its fuel-value. Then follows an exhaustive discussion of various processes of defecation and carbonatation, having for their object the clarifying of the crude cane-juice, and a detailed review of various reagents employed for the purpose.

Under the caption "Concentration of the Juice," the author deals with the preliminary concentration of sugar solutions, vacuum-pans and their accessories, and the working up of by-products.

As is well warranted by its importance, a separate chapter is devoted to the composition and utilization of molasses; Java-molasses, to the study of which the author has given much time and personal attention, receives specific consideration.

The final section of the book deals with factory-output, calculations and records; extensive tables and a satisfactory index conclude the volume.

This brief outline of the book's contents will indicate in how thorough and painstaking a manner the author has acquitted himself of his self-appointed task. His familiarity with the work of other investigators, with that of his American confrères among others, is amply attested by foot-notes and references scattered throughout the volume.

The straightforward, lucid style in which this book is written is characteristic of its author and makes its reading a pleasure, nor must the excellent make-up of the publication pass unnoticed—the quality of paper used, its typography, the marginal indices, all certainly merit the appreciation of its readers.

F. G. WIECHMANN

*An Introduction to the Lie Theory of One-Parameter Groups*, with applications to the solution of differential equations. By ABRAHAM COHEN, Ph.D., Associate in Mathematics, Johns Hopkins University. Boston, D. C. Heath & Co. 1911. Pp. iv + 248. Half leather.

The scope of this attractive little volume may be inferred from its seven chapter headings, which are as follows: Lie's theory of one-parameter groups, differential equations of the first order, miscellaneous theorems and geometrical applications, differential equations of the second and higher orders, linear partial differential equations of the first order, ordinary differential equations of the second order and contact transformations.

In form, binding and paper the present volume is similar to the "Elementary Treatise on Differential Equations," by the same author, published in 1906. In subject matter it forms

a suitable sequel to this work, but it can be read with a more limited knowledge of differential equations. While it should appeal especially to the student of mathematics who is about to begin graduate work in an American university, it should also prove useful to those who make frequent use of the differential equation in applied fields of mathematics and who desire to look at the subject from the systematizing and clarifying standpoint of group theory.

The book closes with an appendix containing seven notes, two tables, answers to the examples, and a good index. In these notes several important subjects are developed for which there was no room in the body of the book. In particular, the  $n$ -parameter group of transformations is considered briefly in one of these notes. The two tables contain forms of differential equations of the first and of higher order which are invariant under known groups.

It is very gratifying to witness the rapid increase of American mathematical literature suitable for students who are just beginning graduate work. Even very good students of mathematics have found the transition period from undergraduate to graduate work discouragingly difficult because they were all at once compelled to use foreign literature with an abrupt change of point of view and method of presentation. During the last decade much has been done to remedy this serious drawback, but there are still many lacunas in this literature. The present volume has reduced by one the number of the most important of these.

G. A. MILLER

#### SPECIAL ARTICLES

##### CARBON DIOXIDE AT HIGH PRESSURE AND THE ARTIFICIAL RIPENING OF PERSIMMONS

It is already known from the work of Prinsen-Geerligs (through Gore, 1910) on the fruit of the banana that its astringency disappears, without softening of the pulp (mesocarp), when surrounded by an atmosphere deprived of oxygen. This result suggested to